

# PATENT SPECIFICATION

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## (54) MIXED FEED ADDITIVES FOR RUMINANTS

(71) We, DEUTSCHE GOLD-UND SILBER-SCHNEIDANSTALT VORMALS ROESSLER, a body corporate organised under the laws of Germany of Postfach 3993 Weissfrauenstrasse 9, 6000 Frankfurt/Main 1 Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to mixed feed additives containing amino acids and/or their nutritively active derivatives or analogues for feeding ruminants. The additives according to the invention are distinguished by limited solubility in aqueous media and hence by only gradual disintegration in the rumen so that the amino acids can be fully utilised by the ruminant.

The use of amino acids as additives to mixed feeds has been known for some time. The addition of these amino acids produces a significant improvement in the quality of the protein component of the feed where amino acids from natural feeds cannot be made available in sufficient quantities. Unfortunately, the range of application has so far been limited solely to monogastric animals.

In the case of ruminants, the addition of amino acids to the feed has never been successful because the products introduced are evidently degraded by the microflora of the rumen. Reis and Schinckel (Australian Journal of Biological Sciences 16 218 (1963) and 17 532 (1964), were able to show that the wool growth of sheep can be considerably increased by directly introducing aqueous solutions of amino acids into the stomach through a fistula by-passing the rumen.

Although of course these tests cannot be applied to feed technology, they do show that the use of amino acids or their nutritively active derivatives or analogues would hold out some prospect of success if it were possible to convert them into a form in which they

would pass through the rumen undamaged and were subsequently made available to the animal either in its stomach or in its small intestine. However, it is of advantage for a small proportion of the amino acids added to be gradually reacted in the rumen itself because as already known it is possible in this way to stimulate microbe growth in the rumen. However, most of the amino acids should be released only in the stomach or small intestine. Extensive efforts to coat amino acids in order to be able to use them for ruminants have always failed either because the coating material was actually attacked by the microflora of the rumen or because it did not dissolve in the stomach or small intestine.

Accordingly, an object of the invention is to provide mixed feed additives containing amino acids for feeding ruminants which are distinguished by the fact that only a small proportion of the amino acids are released in the rumen, by far the greater part being released in the stomach or small intestine.

The invention provides a mixed feed additive for feeding ruminants comprising at least one amino acid and/or a nutritively active derivative or analogue and a synthetic, highly dispersed and hydrophobised silica in a quantity of from 1 to 30% by weight based on the weight of the amino acid or the derivative or analogue thereof.

Nutritively active derivatives or analogues of amino acids are compounds which have the same nutritive effect as the amino acid by being connected to the amino acid *in vivo*.

It has surprisingly been found that the rate of dissolution of amino acids in the rumen medium can be considerably retarded by suitably adding hydrophobised silica to them. The hydrophobised silica which physiologically is completely harmless and which is not affected by the bacterial flora of the rumen, wraps itself round the amino acid crystals like a protective coating and, in doing so, considerably reduces their rate of dissolution. In the

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production of the mixed feed additive according to the invention, every effort must be made to ensure that the amino acids are combined as intimately as possible with the silica. This can be done by intensive mixing, by intensive grinding or, for example, by adding the silica during preparation of the amino acids either before or during crystallisation so as to give a conglomerate in which the amino acids are tightly surrounded by the silica. Apart from amino acids, it is also possible in this way to coat nutritively active derivatives thereof and other active ingredients for feeding animals, such as vitamins, antibiotics and the like, even proteins. In addition to the silica, it is also possible to add other products which further reduce the rate of dissolution of the active ingredients such as, for example, fats, long-chain fatty acids and plastics. Both in the stomach and in the small intestine, the active ingredients are released from the hydrophobic covering by the emulsifiers present therein, such as lecithin etc.

In the context of the invention "highly disperse, synthetically prepared and hydrophobised silica" means wet-precipitated silica and silicas obtained by pyrogenic reaction which have been hydrophobised by treatment with an organosilicon compound, preferably by treatment with an organohalogen silane in the gas phase or in a suspension or in a redispersed filter cake paste, and also products which are obtained by polymerising organosilanol.

The hydrophobised silica preferably has a primary particle size of less than 500 nm, more preferably 3 to 40 nm and a BET specific surface of from 100 to 250 m<sup>2</sup>/g.

The manner in which the additives prepared with hydrophobised silica are active in regard to solution behaviour is illustrated in the following Examples:

#### EXAMPLE 1

DL-methionine was intimately mixed in a tumble mixer with 3% of hydrophobised precipitated silica. The rate of dissolution of the methionine from this product was then determined in water at +40°C. After 1 hour, 48% of the methionine had been dissolved, after 3 hours 58%, after 6 hours 72% and after 24 hours 96%.

If 10% of hydrophobised silica is added to methionine, 40% of the methionine has been dissolved out of the product after 1 hour, 55% after 3 hours, 66% after 6 hours and 84% after 24 hours. Under the same conditions, untreated DL-methionine is completely dissolved in 1 minute at 40°C.

#### EXAMPLE 2

90 parts of DL-methionine and 10 parts of hydrophobised precipitated silica were ground together in a disc-attrition mill. The dissolution rate of the methionine in this product

was again determined. After 1 hour, 36% had been dissolved, after 3 hours 48% and after 6 hours 55%.

The rate at which hydrophobised methionine is dissolved in rumen liquid was measured in Examples 3 and 4.

#### EXAMPLE 3

10% of hydrophobised precipitated silica was added to DL-methionine followed by intimate mixing in a tumble mixer. Thereafter, the rate of dissolution in rumen liquid was determined at +40°C. 42% had been dissolved after 1 hour, 65% after 3 hours and 84% after 6 hours.

#### EXAMPLE 4

90 parts of DL-methionine and 10 parts of hydrophobised precipitated silica were ground in a disc-attrition mill. Its rate of dissolution in rumen liquid was then determined at +40°C. 20% of the DL-methionine had been dissolved after 1 hour, 48% after 3 hours and 65% after 6 hours.

#### EXAMPLE 5

10 parts of hydrophobised silica obtained by polymerising propyl trisilanol were added to 90 parts of DL-methionine. The rate of dissolution in rumen liquid was then determined at +40°C. 20% of the DL-methionine had been dissolved after 1 hour, 22% after 3 hours, 25% after 6 hours and 30% after 24 hours.

#### EXAMPLE 6

90 parts of DL-methionine and 10 parts of hydrophobised silica obtained by polymerising propyl trisilanol were suspended in water and the rate of dissolution measured at 40°C following the addition of 7 ml of a 6% solution of lecithin. As much as 90% of the DL-methionine had been dissolved after only 1 hour.

This test shows that the coated amino acid is released very quickly both in the stomach and in the small intestine of the animal in which a high concentration of emulsifiers is present.

#### WHAT WE CLAIM IS:—

1. A mixed feed additive for feeding ruminants, comprising at least one amino acid and/or a nutritively active derivative or analogue thereof and a synthetic highly dispersed and hydrophobised silica in a quantity of 1% by weight to 30% by weight based on the weight of the amino acid or the derivative or analogue thereof.

2. A mixed feed additive as claimed in Claim 1, wherein the silica is a pyrogenically obtained hydrophobised silica.

3. A mixed feed additive as claimed in Claim 1, wherein the silica is a wet-precipitated and hydrophobised silica.

4. A mixed feed additive as claimed in Claim 1, wherein the silica is a hydrophobised silica obtained by polymerising organo silanols.
5. A mixed feed additives as claimed in any of claims 1 to 3, wherein the hydrophobised silica has a primary particle size of less than 500 nm and a B.E.T. specific surface of from 100 to 250 m<sup>2</sup>/g.
- 10 6. A mixed feed additive as claimed in Claim 5 wherein the primary particle size of the silica is from 3 to 40 nm.
7. A mixed feed additive containing silica substantially as hereinbefore described.

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